CLAIMS

What is claimed is:

1. A deposition system for depositing silica particles onto a workpiece comprising:

(a) a burner for depositing the particles onto the workpiece;

(b) a lathe for holding the workpiece and for rotating and translating the workpiece relative to the burner; and

(c) a computer for controlling the translating and rotating of the workpiece relative to the burner;

wherein the lathe is for at times translating the workpiece at a rate of greater than about 1.4 meters per minute.

2. The deposition system of claim 1, further comprising a casing enclosing the burner and the lathe, wherein the casing includes a plurality of vents.

3. The deposition system of claim 1, further comprising a casing enclosing the burner and the lathe, wherein the casing comprises Hasteloy.

4. The deposition system of claim 1, further comprising two end torches wherein one of the two end torches is adjustable with respect to a distance between the two end torches.

5. The deposition system of claim 1, wherein the workpiece is translated according to a motion profile.

6. The deposition system of claim 1 wherein the workpiece is translated at a speed of at least about seven meters per minute and an acceleration of at least about 250 millimeters per second per second.

7. A deposition system for depositing silica particles onto a workpiece comprising:

(a) a deposition chamber comprising a plurality of components for depositing the particles on the workpiece, an inner skin for substantially enclosing the plurality of components and the workpiece, and an outer skin at least partially enclosing the inner skin;

(b) a gas panel for regulating a flow of deposition material into the deposition chamber; and

(c) a computer for controlling operation of the gas panel and at least one of the plurality of components.

8. The deposition system of claim 7 wherein the inner skin comprises Hasteloy.

9. The deposition system of claim 7, wherein the outer skin includes a plurality of vents for cooling the inner skin of the deposition chamber.

10. The deposition system of claim 7, wherein the outer skin includes a plurality of vents for cooling the inner skin of the deposition chamber.

11. The deposition system of claim 7, wherein one of the plurality of components is an exhaust hood comprised of Hasteloy.

12. A deposition system for depositing silica particles onto a workpiece comprising:

(a) a deposition chamber comprising a plurality of components for depositing the particles on the workpiece,

(b) an exhaust subsystem for exhausting constituents from the deposition chamber; and

(c) an intake subsystem for providing air into the deposition chamber, the intake subsystem comprising a blower for actively conveying air into the deposition chamber and a passive air intake for allowing air into the deposition chamber based on a negative pressure differential between the blower and the exhaust subsystem.

13. The deposition system of claim 12, wherein the intake subsystem and the exhaust subsystem convey the air in a substantially upward direction through the deposition chamber.

14. The deposition system of claim 12, wherein the intake subsystem and the exhaust subsystem provide a laminar flow in a deposition region in the deposition chamber.

15. The deposition system of claim 12, wherein the intake subsystem includes at least one filter for filtering the air conveyed into the deposition chamber.

16. The deposition system of claim 12, wherein the intake subsystem further comprises a diffuser, and the exhaust subsystem includes a plurality of exhausts for providing a substantially upward flow of air substantially throughout the deposition chamber.

17. The deposition system of claim 12, wherein the diffuser is coupled to a bottom wall of the deposition chamber for directing the substantially upward flow of air, and the plurality of exhausts are coupled to a top wall of the deposition chamber for receiving the substantially upward flow of air.

18. The deposition system of claim 12, the deposition chamber further comprising an inner skin for enclosing the plurality of components and the workpiece and an outer skin at least partially enclosing the inner skin.

19. The deposition system of claim 18 wherein the inner skin comprises Hasteloy.

20. The deposition system of claim 18, wherein the outer skin includes a plurality of vents for cooling the inner skin of the deposition chamber.

21. The deposition system of claim 18, wherein one of the plurality of components is an exhaust hood comprised of Hasteloy.

22. A deposition system for depositing silica particles onto a workpiece comprising:

(a) a deposition chamber comprising a plurality of components for depositing the particles on the workpiece;

(b) a gas panel for regulating a flow of deposition material into the deposition chamber; and

(c) a computer for controlling operation of the gas panel and at least one of the plurality of components;

wherein the deposition chamber comprises Hasteloy.

23. A deposition system for depositing particles formed from a vapor comprising a chemical onto a workpiece comprising:

(a) a deposition chamber for depositing the particles on the workpiece,

(b) a reservoir providing a source for the chemical;

(c) a preheater connected to the reservoir for receiving and heating the chemical;

(d) a vaporizer connectedly interposed between the deposition chamber and the preheater for receiving the chemical in a liquid form, heating an amount of the chemical, and outputting at a controlled rate a vaporized form of the chemical to the deposition chamber;

(e) a valve interposed between the preheater and the vaporizer; and

(f) a computer in communication with the valve for controlling flow of the chemical into the vaporizer based on the amount of the chemical in the vaporizer.

24. The deposition system of claim 23, wherein the chemical is silicon tetrachloride and the workpiece is an optical fiber preform.

25. The deposition system of claim 23, wherein the computer actuates flow of the chemical from the preheater into the vaporizer if the amount of the chemical in the vaporizer is below a predetermined minimum amount.

26. The deposition system of claim 23, wherein the computer ceases flow of the chemical from the preheater into the vaporizer if the amount of the chemical in the vaporizer is above a predetermined maximum amount.

27. A deposition system for depositing silica particles onto a workpiece comprising:

(a) a lathe for holding the workpiece;

(b) a burner for depositing the particles onto the workpiece and at least one motor for translating the burner relative to the workpiece; and

(c) a computer for controlling the translating and rotating of the workpiece relative to the burner;

wherein the computer is configured to translate the burner relative to the workpiece at a rate at times greater than about 1.4 meters per minute.

28. An optical fiber preform formed using a cladding deposition system for depositing fused silica onto a start rod, the cladding deposition system comprising:

(a) a lathe for holding the start rod;

(b) a burner for depositing the fused silica onto the start rod and at least one motor for translating the burner relative to the start rod; and

(c) a computer for controlling the translating and rotating of the start rod relative to the burner;

wherein the computer is configured to at times translate the burner relative to the start rod at a rate of greater than about 1.4 meters per minute.

29. A fused silica rod formed using a deposition system for depositing fused silica onto a start rod comprising, the deposition system comprising:

(a) a lathe for holding the start rod;

(b) a burner for depositing the fused silica onto the start rod and at least one motor for translating the burner relative to the start rod; and

(c) a computer for controlling the translating and rotating of the start rod relative to the burner;

wherein the computer is configured to at times translate the burner relative to the start rod at a rate of greater than about 1.4 meters per minute.

30. An optical fiber preform formed using a cladding deposition system for depositing particles onto a workpiece, the cladding deposition system comprising:

(a) a burner for depositing the particles onto the workpiece;

(b) a lathe for holding the workpiece and for rotating and translating the workpiece relative to the burner; and

(c) a computer for controlling the translating and rotating of the workpiece relative to the burner;

wherein the computer is configured to at times translate the workpiece relative to the burner at a rate of greater than about 1.4 meters per minute.

31. A fused silica rod formed using a deposition system for depositing particles onto a workpiece comprising:

(a) a burner for depositing the particles onto the workpiece;

(b) a lathe for holding the workpiece and for rotating and translating the workpiece relative to the burner; and

(c) a computer for controlling the translating and rotating of the workpiece relative to the burner;

wherein the computer is programmed to at times translate the workpiece relative to the burner at a rate of greater than about 1.4 meters per minute.

32. A method of manufacturing an optical fiber preform comprising the steps of:

(a) rotating and translating a start rod; and

(b) depositing fused silica onto the start rod;

wherein at times the start rod is translated relative to the deposition at a rate greater than about 1.4 meters per minute.

33. A method of manufacturing a fused silica rod comprising the steps of:

(a) rotating and translating a start rod;

(b) depositing fused silica onto the start rod to form a fused silica preform; and

(c) sintering the fused silica preform;

wherein at times the start rod is translated relative to the deposition at a rate of greater than about 1.4 meters per minute.

34. A method of manufacturing silica wafers comprising the steps of:

(a) fabricating a start rod;

(b) depositing fused silica on the start rod to produce a fused silica preform;

(c) sintering the fused silica preform to form a fused silica rod; and

(d) reforming the fused silica rod;

wherein the depositing step comprises steps of rotating the start rod and translating the start rod at a rate relative to the deposition of fused silica at times greater than about 1.4 meters per minute.

35. A method of manufacturing optical fiber comprising the steps of:

(a) obtaining a start rod;

(b) depositing fused silica on the start rod to produce an optical fiber preform; and

(c) drawing the optical fiber preform into the optical fiber;

wherein the depositing step comprises steps of rotating the start rod and translating the start rod relative to the deposition of fused silica at a rate at times greater than about 1.4 meters per minute.

36. A method of manufacturing optical fiber comprising the steps of:

(a) obtaining a start rod;

(b) depositing fused silica on the start rod to produce an optical fiber preform; and

(c) drawing the optical fiber preform into the optical fiber;

wherein the depositing step comprises steps of

regulating a flow of deposition material onto the start rod;

rotating and translating the start rod; and

venting a deposition chamber for the start rod by exhausting constituents from the deposition chamber and intaking air into the deposition chamber by actively conveying air into the deposition chamber and passively allowing air into the deposition chamber based on a negative pressure differential between intake and exhaust.

37. A method of manufacturing silica wafers comprising the steps of:

(a) obtaining a start rod;

(b) depositing fused silica on the start rod to produce a fused silica preform;

(c) sintering the fused silica preform to form a fused silica rod; and

(d) reforming the fused silica rod;

wherein the depositing step comprises steps of

regulating a flow of deposition material onto the start rod;

rotating and translating the start rod; and

venting a deposition chamber for the start rod by exhausting constituents from the deposition chamber and intaking air into the deposition chamber by actively conveying air into the deposition chamber and passively allowing air into the deposition chamber based on a negative pressure differential between intake and exhaust.

38. A method of manufacturing an optical fiber preform comprising the steps of:

(a) obtaining a start rod; and

(b) depositing fused silica on the start rod to produce the optical fiber preform;

wherein the depositing step comprises steps of

regulating a flow of deposition material onto the start rod;

rotating and translating the start rod; and

venting a deposition chamber for the start rod by exhausting constituents from the deposition chamber and intaking air into the deposition chamber by actively conveying air into the deposition chamber and passively allowing air into the deposition chamber based on a negative pressure differential between intake and exhaust.

39. A method of manufacturing a fused silica rod comprising the steps of:

(a) obtaining a start rod;

(b) depositing fused silica on the start rod to produce a fused silica preform; and

(c) sintering the fused silica preform;

wherein the depositing step comprises step of

regulating a flow of deposition material onto the start rod;

rotating and translating the start rod; and

venting a deposition chamber for the start rod by exhausting constituents from the deposition chamber and intaking air into the deposition chamber by actively conveying air into the deposition chamber and passively allowing air into the deposition chamber based on a negative pressure differential between intake and exhaust.

40. A method of manufacturing silica wafers comprising the steps of:

(a) obtaining a start rod;

(b) depositing fused silica on the start rod to produce a fused silica preform;

(c) sintering the fused silica preform to form a fused silica rod; and

(d) reforming the fused silica rod;

wherein the depositing step comprises steps of

providing a source for silicon tetrachloride in liquid form;

heating the silicon tetrachloride in liquid form in a preheater;

conveying the heated silicon tetrachloride in liquid form to a vaporizer based on an amount of silicon tetrachloride in the vaporizer;

heating at least a portion of the silicon tetrachloride in the vaporizer into a vaporized form;

outputting at a controlled rate the vaporized form of the silicon tetrachloride to a deposition chamber; and

reacting the silicon tetrachloride with oxygen to produce the fused silica.

41. A method of manufacturing optical fiber comprising the steps of:

(a) obtaining a start rod;

(b) depositing fused silica on the start rod to produce an optical fiber preform; and

(c) drawing the optical fiber preform into the optical fiber;

wherein the depositing step comprises steps of

providing a source for silicon tetrachloride in liquid form;

heating the silicon tetrachloride in liquid form in a preheater;

conveying the heated silicon tetrachloride in liquid form to a vaporizer based on an amount of silicon tetrachloride in the vaporizer;

heating at least a portion of the silicon tetrachloride in the vaporizer into a vaporized form;

outputting at a controlled rate the vaporized form of the silicon tetrachloride to a deposition chamber; and

reacting the silicon tetrachloride with oxygen to produce the fused silica.

42. A method of manufacturing an optical fiber preform comprising the steps of:

(a) obtaining a start rod; and

(b) depositing fused silica on the start rod to produce the optical fiber preform;

wherein the depositing step comprises steps of

providing a source for silicon tetrachloride in liquid form;

heating the silicon tetrachloride in liquid form in a preheater;

conveying the heated silicon tetrachloride in liquid form to a vaporizer based on an amount of silicon tetrachloride in the vaporizer;

heating at least a portion of the silicon tetrachloride in the vaporizer into a vaporized form;

outputting at a controlled rate the vaporized form of the silicon tetrachloride to a deposition chamber; and

reacting the silicon tetrachloride with oxygen to produce the fused silica.

43. A method of manufacturing a fused silica rod comprising the steps of:

(a) obtaining a start rod of fused silica;

(b) depositing fused silica on the start rod to produce a fused silica preform; and

(c) sintering the fused silica preform;

wherein the depositing step comprises steps of

providing a source for silicon tetrachloride in liquid form;

heating the silicon tetrachloride in liquid form in a preheater;

conveying the heated silicon tetrachloride in liquid form to a vaporizer based on an amount of silicon tetrachloride in the vaporizer;

heating at least a portion of the silicon tetrachloride in the vaporizer into a vaporized form;

outputting at a controlled rate the vaporized form of the silicon tetrachloride to a deposition chamber; and

reacting the silicon tetrachloride with oxygen to produce the fused silica.

44. A method of manufacturing an optical fiber preform comprising the steps of:

(a) obtaining a start rod; and

(b) depositing fused silica on the start rod to produce the optical fiber preform;

wherein the depositing step comprises steps of enclosing a region for depositing the fused silica on the start rod using a material substantially comprised of Hasteloy and regulating a flow of deposition material into the region.

45. A method of manufacturing optical fiber comprising the steps of:

(a) obtaining a start rod;

(b) depositing fused silica on the start rod to produce an optical fiber preform; and

(c) drawing the optical fiber preform into the optical fiber;

wherein the depositing step comprises steps of enclosing a region for depositing the fused silica on the start rod using a material substantially comprised of Hasteloy and regulating a flow of deposition material into the region.

46. A method of manufacturing a fused silica rod comprising the steps of:

(a) obtaining a start rod of fused silica;

(b) depositing fused silica on the start rod to produce a fused silica preform; and

(c) sintering the fused silica preform;

wherein the depositing step comprises steps of enclosing a region for depositing the fused silica on the start rod using a material substantially comprised of Hasteloy and regulating a flow of deposition material into the region.

47. A method of manufacturing silica wafers comprising the steps of:

(a) obtaining a start rod of fused silica;

(b) depositing fused silica on the start rod to produce a fused silica preform;

(c) sintering the fused silica preform to produce a fused silica rod; and

(d) reforming the fused silica rod;

wherein the depositing step comprises steps of enclosing a region for depositing the fused silica on the start rod using a material substantially comprised of Hasteloy and regulating a flow of deposition material into the region.

48. A method of manufacturing an optical fiber preform comprising the steps of:

(a) obtaining a start rod; and

(b) depositing fused silica on the start rod to produce the optical fiber preform;

wherein the depositing step comprises steps of

enclosing a region for depositing the fused silica on the start rod with an inner skin comprising a metal alloy and at least partially enclosing the inner skin with an outer skin having a plurality of vents for cooling the inner skin, and

regulating a flow of deposition material into the region.

49. A method of manufacturing optical fiber comprising the steps of:

(a) obtaining a start rod;

(b) depositing fused silica on the start rod to produce an optical fiber preform; and

(c) drawing the optical fiber preform into the optical fiber;

wherein the depositing step comprises steps of

enclosing a region for depositing the fused silica on the start rod with an inner skin comprising a metal alloy and at least partially enclosing the inner skin with an outer skin having a plurality of vents for cooling the inner skin, and

regulating a flow of deposition material into the region.

50. A method of manufacturing a fused silica rod comprising the steps of:

(a) obtaining a start rod of fused silica;

(b) depositing fused silica on the start rod to produce a fused silica preform; and

(c) sintering the fused silica preform;

wherein the depositing step comprises steps of

enclosing a region for depositing the fused silica on the start rod with an inner skin comprising a metal alloy and at least partially enclosing the inner skin with an outer skin having a plurality of vents for cooling the inner skin, and

regulating a flow of deposition material into the region.

51. A method of manufacturing silica wafers comprising the steps of:

(a) obtaining a start rod of fused silica;

(b) depositing fused silica on the start rod to produce a fused silica preform;

(c) sintering the fused silica preform; and

(d) reforming the fused silica rod;

wherein the depositing step comprises steps of

enclosing a region for depositing the fused silica on the start rod with an inner skin comprising a metal alloy and at least partially enclosing the inner skin with an outer skin having a plurality of vents for cooling the inner skin, and

regulating a flow of deposition material into the region.